

lake, distant twenty miles from this place, were distinctly seen on the 17th; the phenomenon lasted thirty minutes.

Mirage were also observed as follows: Yuma, Ariz., 3d, 10th; Fort Bidwell, Cal., 2d; San Diego, Cal., 17th; Webster, Dak., 2d, 3d, 5th, 6th, 8th, 13th, 29th; Woonsocket, Dak., 7th, 10th; Lake Forest, Ill., 30th; Hampton, Iowa, 10th, 11th; Marquette, Nebr., 4th, 8th, 29th to 31st; Green Bay, Wis., 7th.

SAND STORMS.

Sand storms were reported as follows:

San Carlos, Ariz., 18th, 19th; Dodge City, Kans., 18th, 31st; Keeler, Cal., 21st.

SUN SPOTS.

Sun spots were observed during the month as follows:

Mr. John W. James, Riley, McHenry Co., Ill.: reports that no sun spots were visible during the month.

Mr. H. D. Govey, North Lewisburgh, Champaign Co., Ohio: the sun spots observed on the 25th were the only ones seen during the month.

Mr. M. A. Veeder, Lyons, Wayne Co., N. Y.: 2d, faculae appeared by rotation; 24th, spots formed west of sun's meridian.

Prof. F. P. Leavenworth, director, Haverford College Observatory, Pa. (observed by Mr. H. V. Gummere, assistant):

Date, October, 1888.	Number of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Faculae.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
1, 4 p. m. ...	0	0	1	1	0	0	0	0	0	0	Through clouds. *
2, 10 a. m. ...	1	1	0	0	0	0	1	1	1	1	Definition very poor.
3, 3 p. m. ...	0	0	0	0	0	0	0	0	0	0	
4, 4 p. m. ...	0	0	0	0	0	0	0	0	0	0	
5, 3 p. m. ...	0	0	0	0	0	0	0	0	0	0	
8, 9 a. m. ...	0	0	0	0	0	0	0	0	0	0	Definition poor.
9, 4 p. m. ...	0	0	0	0	0	0	0	0	0	0	
10, 4 p. m. ...	0	0	0	0	0	0	0	0	0	0	
13, 11 a. m. ...	0	0	0	0	0	0	0	0	0	0	Definition good.
15, 9 a. m. ...	0	0	0	0	0	0	0	0	0	0	Definition poor.
16, 10 a. m. ...	0	0	0	0	0	0	0	0	0	0	Do.
17, 9 a. m. ...	0	0	0	0	0	0	0	0	0	0	Definition good.
20, 9 a. m. ...	1	2	0	0	1	2	1	2	1	2	Definition very good; faint.
24, 10 a. m. ...	0	0	0	0	0	0	0	0	1	5	Definition poor.
25, 4 p. m. ...	2	17	0	0	0	0	17	2	2	0	Definition very good.
29, 10 a. m. ...	0	0	0	0	0	0	0	0	0	0	Definition good.
30, 10 a. m. ...	0	0	0	0	0	0	0	0	0	0	Definition very poor.
31, 10 a. m. ...	0	0	1	1	0	0	0	0	0	0	Definition good.

* Observed by Prof. F. P. Leavenworth.

VERIFICATIONS.

INDICATIONS FOR 24 HOURS IN ADVANCE.

The percentages of verifications of the 8 p. m. daily indications for October, 1888, as determined from comparison of succeeding telegraphic reports, are given in the table below.

The predictions for districts east of the Rocky Mountains for October, 1888, were made by Professor Cleveland Abbe, and those for the Pacific Coast districts were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps; the verifications for all districts were determined by Assistant Professor C. F. Marvin.

Percentages of indications verified, October, 1888.

States.		States.	
Maine	76.3	Tennessee	74.0
New Hampshire	75.8	Kentucky	76.9
Vermont	73.9	Ohio	67.0
Massachusetts	75.5	West Virginia	68.2
Rhode Island	77.4	Indiana	74.8
Connecticut	78.2	Illinois	75.1
Eastern New York	75.5	Lower Michigan	76.5
Western New York	73.0	Upper Michigan	74.5
Eastern Pennsylvania	74.6	Wisconsin	73.2
Western Pennsylvania	67.5	Minnesota	71.9
New Jersey	77.3	Iowa	74.4
Delaware	76.1	Kansas	71.7
Maryland	74.8	Nebraska	76.1
District of Columbia	77.0	Missouri	78.8
Virginia	78.0	Colorado	71.0
North Carolina	83.0	Eastern Dakota	74.2
South Carolina	85.7	Southern California*	93.7
Georgia	84.3	Northern California*	91.9
Eastern Florida	76.0	Oregon*	78.1
Western Florida	74.8	Washington Territory*	77.9
Alabama	80.6	By elements: Weather	80.5
Mississippi	78.1	Temperature	68.4
Louisiana	74.5	Monthly percentage of weather and temperature combined†	75.7
Texas	77.3		
Arkansas	78.8		

* In determining the general percentage for the different elements the Pacific coast states are not included. † The monthly percentage of weather and temperature combined is determined by multiplying the percentage of weather by 6, and the percentage of temperature by 4, and dividing their sum by 10.

combined is determined by multiplying the percentage of weather by 6, and the percentage of temperature by 4, and dividing their sum by 10.

CAUTIONARY SIGNALS FOR OCTOBER, 1888.

Statement showing percentages of justifications of wind signals and cold-wave signals for the month of October, 1888:

Wind signals.—Total number of signals ordered, one hundred and seventy-three. Number of cautionary signals ordered, one hundred and sixty-nine; justified, wholly or in part, ninety. Number of storm signals ordered, four; justified, three. Number of signals ordered for easterly winds, eighty-four; justified, seventy-eight. Number of signals ordered for westerly winds, eighty-nine; justified, seventy-nine. Number of signals ordered late, ten. Number of storms without signals, twenty-three. Percentage of justifications, 62.3.

Cold-wave signals.—Total number of signals ordered, one hundred and thirty-two; justified, wholly or in part, forty. Number of severe cold-waves without signals, twelve. Percentage of justifications, 27.4.

LOCAL VERIFICATIONS.

The following extracts from the published reports of the state weather services for October, 1888, show the percentages of verifications of weather and temperature signals:

Nebraska.—The percentages of correct predictions for the state were: temperature, 89.7; weather, 82.1; mean, 85.9.

Ohio.—The percentages of verifications of weather signals (received from Washington and distributed to thirty-two stations) were: weather, 75; temperature, 80.

South Carolina.—The percentages of verifications for the state were: weather, 86.5; temperature, 84.5.

Tennessee.—The percentages of verifications of weather and temperature predictions for the month at the following stations were: Jonesborough, weather, 90.0; temperature, 96.8. Clarksville, weather, 85.2; temperature, 63.0. Pulaski, weather, 80.0; temperature, 80.0. Burkesville, weather, 92.0; temperature, 100.0.

STATE WEATHER SERVICES.

[Temperature in degrees Fahrenheit; precipitation, including melted snow, in inches and hundredths.]

The following extracts are republished from reports for October, 1888, of the directors of the various state weather services:

ALABAMA.

From the 1st to the 13th the sky was overcast with heavy clouds and the weather was generally threatening, with high temperature, and low pressure. The second period of low pressure, from the 19th to the 26th, produced heavy rains over the entire state, with correspondingly high temperature. The clear

and fair days of the month generally occurred on those days when high pressure waves were crossing the state.

The average temperature was 5.5 below the normal. The average precipitation was 1.29 above the normal. The month was generally mild with but few cool days, and the frosts that occurred were light.